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MATERIAL FEED AND METHOD FOR THE DISTRIBUTION OF A FIBROUS SUBSTANCE SUSPENSION IN THE MATERIAL FEED OF A PAPER MACHINE

[Stoffauflauf und Verfahren zur Verteilung einer Faserstoffsuspension im Stoffauflauf einer Papiermaschine]

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Description /2*

The invention refers to a method for the distribution of a fibrous substance suspension in the material feed of a paper machine, in which the fibrous substance suspension is conducted into a nozzle, from at least one distributor, via a guiding device, from which it exits via a slit.

The invention also concerns a material feed for a paper machine with a distributor for the distribution of a fibrous substance suspension via the machine width, which is connected with a nozzle via a guiding device, from which the fibrous substance suspension exits via a slit, and with a metering device, with metering conduits for the metering of additives.

A device and a method, in accordance with the type mentioned in the beginning, are known from DE 44 16 898 C2.

According to this, the material feed comprises a guiding device with a first turbulence insert in the form of a tubular distributor, which discharges into a mixing chamber and which is followed by a second turbulence insert in the form of a tubular distributor, which goes over into the nozzle. A number of tubes which are arranged approximately vertical to the main flow direction discharge into the mixing chamber; from these tubes, additives can be admixed to the fibrous substance suspension via various exit openings located above one another.

In this way, a local admixing of dilution water to the main flow of the fibrous substance suspension is to be attained in such a way that with simple means, the admixing can take place as uniformly as possible over the entire height of the suspension layer, so that a uniform influencing over the thickness of the sheet produced is possible.

In paper production, special paper characteristics on the web surface or in the boundary layers are frequently desired. If a good imprinting capacity is perhaps desired, then, for example, a high filler

* [Numbers in right margin indicate pagination of the original text.]

content is required on the surface. On the other hand, it is desirable to implement the needed surface characteristics or boundary characteristics only in the surface layers or boundary layers, so as to keep the costs of the additives low.

With one-layer material feeds, it has not been possible up to now to vary the material characteristics in such a way that different characteristic features can be produced in the z direction.

In order to make possible a variation of the characteristics in the z direction, multilayer material feeds were therefore frequently used, in which the fibrous substance web is produced, for example, from a middle layer, from an upper layer, and a lower layer.

Such multilayer material feeds have predominantly been used, up to now, however, for the production of packaging paper and paper board. In this case, for example, at least inferior waste paper is introduced into the middle layer of a three-layer paper and paper materials with a degree of strength or whiteness which is higher, in comparison to the middle layer, into the outside layers.

A use of multilayer material feeds for the production of papers with increased filler content and improved imprinting capacity characteristics in the boundary layers has been considered only theoretically up to now (see T. Schaible, A. Bublik, "Experiences and perspectives in the formation of multilayer sheets," Das Papier, 1993, No. 10A, pages V140-V149), but has not yet been accepted in practice, however, because of various problems.

Accordingly, the goal of the invention is to create a method for the distribution of a fibrous substance suspension in the material feed of a paper machine and a material feed wherein a purposeful influencing of the paper characteristics is made possible, in as simple a manner as possible, even with highly filled papers, on the sheet surface or in the boundary zones, and wherein, additionally or alternatively, a purposeful influencing of the imprinting capacity characteristics with graphic papers is made possible.

Furthermore, a suitable material feed is to be created, with which the advantages of the optimization of the paper characteristics in the z direction–in particular, with graphic papers with one or more layers also–can be utilized. In addition, the pressure losses in the pertinent metering conduits should be kept as low as possible and as uniform as possible an adjustment of the additives should be made possible.

The goal of the invention is attained with a method, in accordance with the type mentioned in the beginning, in that different additives are metered to the fibrous substance suspension on at least two different levels in the z direction.

The goal of the invention is completely attained in this manner.

In accordance with the invention, namely, a purposeful influencing of the characteristics of the fibrous substance suspension in the z direction is made possible, already with a one-layer material feed, in that, at different levels in the z direction, different additives are metered in.

In this way, an intensive washing out of fine substances and fillers on the sheet surface and a deficient transport of fine substances and fillers from the sheet middle on the surface, which in the state of the art always lead to an impoverishment of the fillers on the surface, can be purposefully balanced out.

Fillers or chemicals, in particular, retention agents or starch, perhaps also fibrous substance suspensions or mixtures thereof, can be taken into consideration hereby as additives. The individual additives can be distinguished, from one another, by their chemical composition, by their concentration or their physical state or their characteristics. They can also be fibrous substance suspensions of various /3
origins, such as from waste paper or freshly produced suspensions, bleached or unbleached, wood-containing or woodfree, or also additives with synthetically produced fibers–for example, plastic fibers. In addition, additives which influence imprinting capacity, with particular preference also,

substances which influence mechanical characteristics, for example, strength, or produce a specific shrinkage behavior, so as to create, for example, a pretension, are conceivable.

It is clear that the principles of the invention can also be used advantageously with a multilayer material feed. The characteristics of the paper produced can be influenced, in particular, with regard to the production of highly filled papers and/or those which can be imprinted well, in order to produce, for example, papers with filler contents of at least 12%.

To this end, seen in the z direction, a fibrous substance suspension that brings about better imprinting capacity characteristics than the suspension supplied to the middle of the page is supplied to the boundary areas. It can be a fibrous substance suspension with a higher freeness value and/or with a higher filler or fine substance content. In addition, a fibrous substance suspension can be supplied to the middle of the sheet, which brings about a higher strength–that is, contains, for example, more chemically digested fibers or stronger fibers.

Thus, the imprinting capacity and the mechanical characteristics can be optimally coordinated with the desired paper quality.

In accordance with an advantageous refinement of the method of the invention, less retention agent is metered to the middle of the sheet, seen in the z direction, than to the boundary areas of the fibrous substance suspension.

In this way, a transport of fine substances and filler from the middle of the sheet to the surface is facilitated and an increased concentration of fine substances and fillers on the surface of the sheet is made possible.

In a preferred embodiment of the invention, smaller amounts of fillers and/or fine substances are metered to the middle of the sheet, seen in a z direction, than to the boundary areas.

By means of these measures, it is possible to purposefully attain a stronger concentration of fillers and/or fine substances on the surface of the sheet and thus, improved characteristics on the surface of the sheet. Thus, it is possible to counteract a filler impoverishment on the surface; up to now, even when using a multilayered material feed, this was to be feared as a result of the washing out of fine substances and fillers on the surface of the sheet.

In an additional refinement of the invention, the pulp consistency of the fibrous substance suspension over the machine width–that is, in the y direction–is regulated in zones, whereas the zone volume flows of the fibrous substance suspension are maintained essentially constant.

According to this method, which is in fact known (see, for example, EP 0 565 923 A1), it is advantageously possible to purposefully influence the pulp consistency of the fibrous substance suspension over the machine width, whereas the fiber orientation profile is practically not impaired.

It is clear that by the admixture of additives, the weight per unit area transverse profile and the fiber orientation transverse profile should not be influenced if at all possible.

For this reason, provision is made, in accordance with a refinement of the invention, so that the volume flows of the metered-in additives are maintained constant by admixing an accompanying aqueous medium.

This measure has the advantage that with a change in the quantity of the metered-in additives, the individual total flow, which is supplied via a metering conduit, is maintained constant and thus compensation flows in the nozzle in the transverse direction are avoided when the quantity of the metered-in additives is changed.

In accordance with another development of the invention, the additives in the guiding device are metered-in, through the nozzle and/or in the distributor.

In this way, the influencing of the characteristics by the metering-in of various additives can be carried out, in a particularly purposeful manner, at the required sites.

In accordance with another development of the invention, the metering-in over the machine width, in the y direction and/or in the z direction, is regulated in zones.

This measure has the advantage that the metering quantity of the individual additives can be coordinated optimally with the desired paper quality.

In accordance with another development of the invention, a change in the weight per unit area, caused by the metering-in of additives over the machine width in the y direction, is balanced out via a regulation of the material flow from the distributor and an admixed fibrous substance suspension with another concentration.

Even if the volume flow of the metered-in additives is maintained constant, as stated before, the weight per unit area transverse profile is nevertheless influenced, if necessary, with a greater variation of the metered-in additives. This change is advantageously balanced out via a regulation of the material flow from the distributor and an admixed fibrous substance suspension with another concentration, so that in spite of a variation of the volume flow of individual additives, the desired weight per unit area transverse profile can be maintained.

Since, in particular, the mechanical paper characteristics over the machine width, seen in the y direction, can come out worse at the boundary areas, different fibrous substance suspensions or additives /4
can be supplied in the boundary areas, in quantities or with characteristics different from those in the middle area, in another refinement of the invention, in the y direction.

The goal of the invention is also attained with a material feed, in accordance with the type mentioned in the beginning, in that in the area of at least one layer, different metering conduits discharge at least two different levels in the z direction.

As mentioned before already, the metering conduits can discharge into the guiding device, into the nozzle, and/or into the distributor.

In this way, it is possible to attain, in accordance with the invention, a purposeful influencing of the characteristics of the fibrous substance suspension in the z direction, so as to attain, for example, an improved paper quality on the surface of the sheet, even with a one-layer material feed.

In accordance with a variant of the invention, several metering conduits are arranged, in succession, down flow, in the x direction.

This measure has the advantage that, for example, anionic and cationic retention agents can be metered in, one after the other, in the desired manner, so as to attain a particularly effective binding effect of the fine substances and fillers to the fibrils.

The guiding device advantageously comprises a turbulence generator, constructed as a tubular distributor or as a plate distributor. Such turbulence generators have proved to be particularly effective in actual practice.

In an additional development of the invention a regulating device is provided for the regulation of the volume flow of the metered-in additives, which makes possible a regulation of the supply of the additives, separated in the y direction and/or in the z direction.

In this manner, it is possible to attain a particularly purposeful influencing of the characteristics of the paper produced both in the y direction as well as in the z direction.

In accordance with a refinement of the invention, a device for the admixing of an accompanying substance is provided in the metering conduits; the device guarantees a constant maintenance of the total volume flow in the metering conduit with a change in the quantity of the additive in a metering conduit.

In this way, the total volume flow in the metering conduit can be maintained constant with a variation of the quantity of the additive, in order to thus avoid an influencing of the fiber orientation transverse profile.

In the nozzle, at least one lamella is provided in a preferred refinement of the invention.

In addition, at least some of the metering conduits can discharge via the lamella.

In this way, the lamella itself can be used for the purposeful metering-in of additives.

The goal of the invention is also attained with a material feed for a paper machine with a distributor for the distribution of a fibrous substance suspension via the machine width, which is connected with a nozzle via a guiding device, wherein the material feed, seen over the machine width, comprises several sections, to which additives, in particular, dilution water, can be admixed locally via several exit openings, with metering conduits and regulating elements, in that correlated with several sections, there is an individual metering conduit, which is subdivided into several conduit branches that are connected with the exit openings.

Since the exit openings, which are located in the distributor, the guiding device, or in the nozzle of the material feed, are provided directly via a conduit branch with the individual additive, the pressure decline is hereby considerably reduced in the individual conduit branches, since each conduit branch is directly connected with the pertinent source, via which the additive is supplied.

Thus, in total, a clearly lower pressure decline is produced at various exit openings, so that a clearly more uniform section by section admixture of the individual additive is guaranteed.

In another development of the invention, the various conduit branches are coupled with a common regulating element in at least one metering conduit.

In this way, a particularly simple construction is produced.

In an alternative model, several conduit branches are provided with a regulating element in at least one metering conduit.

In this way, it is possible to attain a locally optimized adjustment of the quantity of the admixed additive.

In accordance with another development of the invention, the various conduit branches discharge from opposite sides into the section in at least one metering conduit.

In this way, the pressure losses are reduced from the individual exit openings provided, successively, on the conduit branches, since the conduit branches discharge not only from one side, but rather from two sides, into the pertinent section, wherein the number of the exit openings to be provided by a conduit branch is correspondingly reduced and thus, the pressure loss is correspondingly reduced.

Such a model is particularly preferred if the various conduit branches discharge from above and from below into the section, as may be the case with a graduated diffuser with a high row number, which must be supplied by the various conduit branches. /5

In this way, an extensively uniform distribution of the admixed additives is made possible, in particular, in the z direction.

In accordance with another development of the invention, the various conduit branches discharge, next to one another, into the section seen in the y direction in at least one metering conduit.

In this way, a more uniform supply of the additives to be supplied into a section is guaranteed.

In accordance with another development of the invention, the various conduit branches successively discharge into the section seen in the main flow direction in at least one metering conduit.

In this way, it is possible to attain a particularly purposeful metering of the additives to be admixed in the main flow direction.

It is thereby possible to attain a purposeful quantitative control, particularly if the individual conduit branches are provided with their own regulating elements.

In accordance with another embodiment of the invention, the sections which are provisioned, via the metering conduits, with additives to be admixed, are constructed with different widths.

This measure has the advantage that the expense of the conduit guide and the regulating expense for the pertinent sections can be adapted to the resolution over the machine width.

It is clear that the aforementioned features and the features which have yet to be explained below can be used not only in the indicated combination, but also in other combinations or in a position by itself without leaving the scope of the invention under consideration.

Other features and advantages of the invention are produced from the description of preferred embodiment examples, below, with reference to the drawing. The figures show the following:

Figure 1, a first embodiment of a material feed, in accordance with the invention, in an extremely schematic representation;

Figure 2, a modification of the embodiment, in accordance with Figure 1;

Figure 3, another modification of the embodiment, in accordance with Figure 1;

Figure 4, another modification of the embodiment, in accordance with Figure 1;

Figure 5, a schematic representation of the explanation of the optimal inflow angle during the mixing of two partial flows, with a constant maintenance of the total volume flow;

Figure 6, a top view of another embodiment of a material feed, in accordance with the invention;

Figure 7, a top view of a modification of the embodiment, in accordance with Figure 6;

Figure 8, a three-layer material feed, which can be used for the method, in accordance with the invention;

Figure 9, a longitudinal section through another embodiment of a material feed with an improved supply for the metering-in of the additives; and

Figure 10, a cross-section through a part of the tubular distributor or graduated diffusor, in accordance with Figure 9, in a schematic representation.

Figure 1 schematically represents a material feed, in accordance with the invention, in cross-section and is designated, as a whole with the number 10.

The material feed 10 comprises a distributor 11, which is constructed as a transverse flow distributor and tapers, in a known manner, in the direction of the material flow. A guiding device 12 follows the distributor 11; it comprises a turbulence insert, which is constructed as a tubular distributor (plate distributor) of a known model. The tubular distributor 13 discharges into a nozzle 14; a slit 19, for the exiting of the fibrous substance suspension, is formed on its front end.

The nozzle 14 can also be subdivided into several partial areas.

Several metering conduits 20, 21, 22 and 23, 24, 25 and 26, 27, 28, in which valves 29 are provided, discharge into the transition area between the distributor 11 and the tubular distributor, as well as into the tubular distributor 13 and also into the nozzle 14.

Several such metering conduits are located, next to one another, over the machine width–that is, in the y direction–although it is not clear from the drawing plane, in accordance with Figure 1. The metering conduits 20-22 and 23-25 and 26-28 discharge into the distributor 11 and into the tubular distributor 13 and into the nozzle 14 at various levels in the z direction. Thus, certain additives can be, purposefully, metered in, via the metering conduits 20–28, at various sites of the material feed.

The metered-in materials can be fillers, fibrous substances, chemicals, in particular, retention agents, starch, or also fibrous substance suspension, or mixtures of these metering media.

As is indicated by the regulation device 18, it is possible to control the metering quantity of each individual metering conduit 20-28, wherein, at the same time, regulation can be provided in such a way that, perhaps, by admixture of an aqueous additive, for example, back water, the total volume flow of each individual metering conduit remains constant, in spite of a change in the quantity of the metered-in additive. In this way, the formation of compensating flows in the z direction in nozzle 14 by a variation of the individual volume flows is avoided, which would lead to changes of the fiber orientation transverse profile. /6

Less retention agent can be purposefully metered into the middle of the sheet than into the boundary areas via the metering conduits 20-28. In addition, a smaller amount of fillers can be metered into the middle of the sheet than in the boundary areas. In this way, an increased concentration of fine substances and fillers on the sheet surface is supported. The high fine substance content in the boundary area thereby forms a filter auxiliary layer, by means of which fine substances and fillers are retained on the surface. By means of the smaller retention agent quantity in the middle of the sheet, a smaller binding effect of fine substances and fillers in this zone is brought about on the fibers, wherein the transport of the fine substances and fillers to the surface of the sheet is supported.

In addition, a fibrous substance suspension with a higher freeness value than in the middle of the sheet can be metered into the boundary areas, seen in the z direction.

To this end, however, another distributor is required, since the freeness value of the fibrous substance suspension cannot be changed by the metering in of an additive.

This possibility will be explained later with the aid of Figure 7.

Moreover, the previously mentioned variation of the additives or the freeness value of the fibrous substance suspension can take place not only in the z direction, but rather also over the machine width in the y direction, so as to counteract worsened characteristics in the boundary areas.

A modification of the embodiment, in accordance with Figure 1, is shown in Figure 2 and is designated, as a whole, with the number 30.

Here too, the fibrous substance suspension is supplied via a distributor 31, constructed as the transverse flow distributor, and arrives from there at nozzle 34 via a guiding device 32; from the nozzle it exits via a slit 39. The guiding device 32 comprises a first turbulence insert, constructed as a tubular or plate distributor 33, which is connected with a mixing chamber 35, which is connected to a second turbulence insert, constructed as a tubular or plate distributor 36.

In the nozzle 34, a lamella 37 is also provided–that is, a plate which is extends over the width of the web and which protrudes into the space of the nozzle 34 and is affixed either horizontally or inclined or is affixed, in an articulated manner, at its end, facing the plate distributor 36.

Figure 2 shows, as a whole, four metering conduits 40-43, which protrude into the mixing chamber 35 and, all total, three metering conduits 44-46, which protrude into the front part of the nozzle 34. The two metering conduits 40, 41 are located directly behind one another, seen in the direction of flow, and discharge at the same level, in the z direction, at the upper end of the mixing chamber 35. They are also arranged directly behind one another, in the direction of flow.

The three metering conduits 44, 45, 46 discharge into the nozzle 34, at different levels, in the z direction.

Again, valves 49 are provided in all metering conduits 40-46, so as to be able to meter the additives in the desired manner.

Another modification of a material feed, in accordance with the invention, is shown in Figure 3 and is designated, as a whole, with the number 50.

The fibrous substance suspension is hereby, again, supplied via a distributor 51, constructed as a transverse flow distributor, from which it arrives at the nozzle 54 via a guiding device 52, in the form of a tubular distributor, from which the fibrous substance suspension flows out via the slit 59.

In Figure 3, three metering conduits 60-62 are shown, which discharge into the tubular distributor 53 at different levels, in the z direction.

In contradistinction to the previously described embodiment, two lamellae 57, 58, arranged above one another, are situated in the nozzle 54; they are connected with metering conduits 63, 64, so that additives metered-in via the metering conduit 63, 64 can exit at the front side of the lamellae 57 and 58.

It is clear that in a modification thereof, an exit could also be provided on the upper side or underside of the lamellae.

Again, valves 69 for the regulation are provided in metering conduits 60-64.

Another modification of a material feed, in accordance with the invention, is shown in Figure 4 and, as a whole, is designated with the number 70.

Again, the fibrous substance suspension is supplied via the distributor 71, constructed as a transverse flow distributor, and arrives, from there, via the guiding device 72, which is constructed as the tubular distributor or plate distributor 73, at the nozzle 74, from which it flows out via a slit 79.

Figure 4 shows three metering conduits 80, 81, 82, which discharge into the tubular distributor 73, and again, are interrupted by valves 89.

In contrast to the previously described embodiments, the metering conduits 80-32 do not discharge vertically into the tubular distributor 73, but rather at an obtuse angle, which is selected in such a way that even with a change in the flow of the additives by the metering conduits 80-82, the individual total volume flow through the pertinent tubular conduit of the tubular distributor 73 is not changed. /7

This measure has the advantage that independent of the quantity of the metered-in additives, the individual total volume flow through the individual tubes of the tube distributor 73 is not changed, so that despite a change in the quantity of the metered-in additives in the nozzle 74, compensatory flows cannot arise, so that the fiber orientation profile is not influenced in this way.

It is clear that a constant maintenance of the individual volume flows by the metering conduits 80-82 can, of course, also be attained in another manner, in that corresponding regulation circuits are provided or in that an aqueous flow, in particular, back water, is again mixed in, at a corresponding angle, so that the total volume is not changed by the individual metering conduits 80-82 even if the individual metering media are supplied in a different amount.

Figure 5 shows a mixing device to mix two volume flows, as they can be used in accordance with EP 0 565 923 A1.

The mixing device designated as a whole by number 90, comprises a first tube to conduct a main flow 92 in the direction of an arrow 93, into which a second tube, for the guiding of a secondary flow 96 in the direction of an arrow 95, forming an angle between the two tubes, discharges.

The secondary flow 96, flowing into the main flow 92 in the direction of the arrow 95, can be regulated via a valve 94.

The angle between the two flows 92, 96 is selected in such a way that even with a change in the volume flow of the secondary flow 96 of the total volume flow, due to the exit end 98, is not changed within broad limits. The angle is mostly in the range between approximately 85° and 87°. By an additional throttle site 97, after the unification of the main flow 92 and the secondary flow 96, the desired linearity is improved.

Such mixing devices 90 are used, in order to be able to regulate the weight per unit area transverse profile, in the y direction, as is basically known from EP 0 565 923 A1, and is explained subsequently with the aid of Figure 6.

In Figure 6, a material feed in accordance with the invention is designated as a whole with the number 100.

The material feed 100 comprises a first distributor 100 to guide a fibrous substance suspension with a relatively high fibrous substance concentration and a second distributor 106, with a smaller diameter, in which, preferably, back water is conducted.

The second distributor 106 is connected with a mixing device 109, via valves 107 and conduits 108, which is constructed according to the principle explained by Figure 5 and in the dilution water from the second distributor 106, admixture takes place in the volume flow from the first distributor 101, without in this way, the total volume flow being changed by the individual conduit 110. The mixing devices 109 are connected with a subsequent guiding device 102, via the conduits 110, to which, in turn, the nozzle 104 is connected. The guiding device 102 comprises, in turn, a tubular distributor 103, constructed as a plate distributor, into which metering conduits 111, 112, 113 discharge at different levels, in the z direction, in order to be able to meter in various additives.

Finally, the fibrous substance web 105 exits from the nozzle 104.

By the arrangement in accordance with Figure 6, it is possible to influence, in the desired manner, the weight per unit area transverse profile, without disadvantageously changing the fiber orientation transverse profile. At the same time, it is possible to meter in additives via the metering conduits 111-113, in the desired manner, in order to purposefully influence characteristics in the z direction or in the y direction.

Figure 7 shows another modification of a material feed, in accordance with the invention, and is designated as a whole with the number 120.

The embodiment in accordance with Figure 7 differs from the embodiment previously described with the aid of Figure 6, in that in addition to the two distributors for the fibrous substance suspension with a high concentration and for the fibrous substance suspension with a low concentration (back water), a third distributor is provided, so as to make possible the purposeful metering of fibrous substance suspensions with a higher or lower freeness value.

A first distributor 121 is used for the main provisioning of the material feed 120 in the middle area except for the boundary zones, seen in the y direction. A fibrous substance suspension with a relatively low freeness value is supplied to this distributor 121.

Another distributor 137 is used to supply a fibrous substance suspension with a higher freeness values, which is preferably supplied to the boundary areas.

A third distributor 126 is used to supply back water for the dilution of the fibrous substance suspension, branched off from the first distributor 121 or the second distributor 137. The third distributor 126 is again connected, via valves 127 and conduits 128 with mixing devices 129, to which fibrous substance suspension is supplied from the second distributor 137, or is connected, via valves 127 and conduits 131, with mixing devices 132, to which fibrous substance suspension is supplied from the first distributor 121.

The mixing devices 129 and 132 are finally connected, via conduits 130 and 133, with the tubular distributor 123.

Thus, seen in the y direction, a fibrous substance suspension with a higher freeness value is supplied to the boundary areas of the fibrous substance web 125 than that supplied in the central area, which is /8
provisioned from the first distributor 121.

Again, additive substances can be metered into the tubular plate 123, via metering conduits 134-136, at different levels, so as to attain a purposeful influencing of the characteristics of the fibrous substance web 125.

Figure 8 shows a three-layer material feed for the carrying out of the method in accordance with the invention and is designated as a whole with the number 140.

The material feed 140 comprises a first distributor 141 to hold a fibrous substance suspension with a high concentration, which is admixed from a secondary distributor 142, via valves 143 and conduits 144, via mixing devices 145 with throttle sites 146, to a fibrous substance suspension with a lower concentration, for example, back water, for the regulation of the pulp consistency transverse profile. Two other distributors 148 and 150 are provided to hold a fibrous substance suspension, which is supplied to the upper and lower boundary areas, in order to purposefully improve the imprinting capacity in the boundary areas. The three fibrous substance suspensions are conducted into nozzles 154, via conduits 147, 149, 151 and guiding devices 152, from which they are shot out via slits for the formation of a fibrous substance web 155 between a lower screen 157, conducted via a screen guiding roller 158, and an upper screen 159, conducted via a screen guiding roller 158.

In Figure 9, another material feed in accordance with the invention for a paper machine is designated as a whole with the number 210.

The material feed 210 comprises a distributor 212, constructed as a transverse distributor, which is connected with a nozzle 218, via a guiding device 214, from which the supplied fibrous substance suspension exits via a machine-wide slit 220.

The guiding device 214 comprises a tubular distributor 16 or graduated diffusor with a large number of tubes, whose structure can be seen in more detail from the sectional representation, in accordance with Figure 10.

The material feed 210 is subdivided into several sections S_1, S_2, S_3..., seen over the machine width (y direction), as can be seen in Figure 10.

An additive, in particular dilution water, is admixed in a regulated manner to each individual section, so as to make possible a local pulp consistency regulation without having to adjust the slit 220.

In accordance with Figure 9, for example, three metering conduits are provided for an individual section; they discharge from different exit openings into the distributor 212, into the tubular distributor 216, and into the nozzle 218.

Since every metering conduit 222, 234, 248 has several exit openings, the metering conduits 222, 234, 248 are subdivided into individual conduit branches, in order to keep the pressure loss at the exit openings lower and in order to guarantee a more uniform distribution of the additive in the z direction.

The first metering conduit 222, which discharges into the transition area between the distributor 212 and the tubular distributor 216, is fed with back water from a common feed conduit 226 and can be regulated via a common regulating element, which can be designed as a valve controlled by a motor. The metering conduit 222 is subdivided into two conduit branches 228, 230, which discharge, from below and from above, into the transition area between the distributor 212 and the tubular distributor 216, and whose ends are connected to form a closed ring conduit. The dilution water exits via several exit openings arranged above one another in the z direction, of which, for example, three exit openings 231, 232, 233 are shown.

By the subdivision of the metering conduit 222 into two conduit branches, which provision, from opposite sides, the exit openings 231, 232, 233, arranged one behind the other, the pressure loss is clearly reduced and a uniform distribution of the dilution water in the z direction is guaranteed.

The second metering conduit 234 is fed from a feed conduit 238 with dilution water, whose volume flow can be regulated via a common regulating element 236. After the regulating element 236, the

metering conduit 234 is subdivided, via a distributor 235, into the individual conduit branches 240, 242, 244, which discharge, one after another, seen in the x direction, at various levels, into the tubular distributor 216, in the z direction, and from which the dilution water exits via exit openings, of which, for example, the exit openings 245, 246, 247 are shown.

The third metering conduits 248 is, again, fed from a common feed conduit, but the metering conduit 248 comprises three completely separate conduit branches 258, 260, 262, which are connected, via a regulating element 250, 252, 254, with the feed conduit 256, and which discharge into the nozzle 218, at their lower ends, at various levels, so as to be able to feed dilution water, via exit openings, of which, for example, the exit openings 263, 264, 265 are shown, at various levels, in the z direction.

Figure 10 shows a section from a tubular distributor, in enlarged representation, in cross-section. The tubular distributor or graduated diffusor consists of a large number of individual tubes, which extend in the direction of the main flow--that is, in the x direction--and expand, in the form of stages, in the x direction. Metering conduits are provided in the z direction, so as to be able to mix dilution water.

The tubular distributor is subdivided, like the entire material feed, over the machine width–that is, in the y direction–into individual sections S_1, S_2, S_3..., which can be regulated individually, so as to make possible a local pulp density regulation over the machine width. Each section S_1, S_2 is provisioned with dilution water by one metering conduit 282, 284. Each metering conduit 282, 284 is subdivided into two conduit branches 266, 258 and 286, 288, which discharge from above and from below into the tubular /9
distributor. The conduit branches are subdivided once more into two partial strands within the tubular distributor, which extend between the individual tubes 270 in the z direction, as is shown by way of example by the partial strands 274, 276, and from which dilution water passes, via exit openings 272, into the tubes 270 of the tube distributor.

Since the dilution water is supplied in each case from above and from below via the partial branches of the individual metering conduit into the tubular distributor, as is indicated by the arrows 278, a clearly reduced pressure decline is produced along the path through the tubular distributor as a whole, within each metering conduit 282 and 284, since in comparison to traditional metering conduits, which discharge only from above or from below with a conduit branch, into the tubular distributor, the quantity of the exit openings to be provisioned via a conduit is halved.

Furthermore, another leveling of the quantity of the admixed fluid seen in the z direction is produced due to the opposite flow direction from two sides.

It is clear that this embodiment, of course, can also be used with particular advantage for the supply of the additives in the form of fillers, chemicals, in particular, retention agents, starch, fibrous substance suspensions, or the like, or mixtures thereof, at various levels in the z direction, for the purpose of influencing the paper characteristics. To this end, the metering conduits 258, 260, 262 which discharge into the nozzle 218 at various levels in the z direction, could, for example, be constructed as ring conduits in individual sections that are fed individually from individual distributors. This embodiment can be combined with the aforementioned embodiments–that is, be used only for the supply of dilution water, whereas additionally, different additives are metered-in in the z direction.

Claims

1. Method for the distribution of a fibrous substance suspension in the material feed of a paper machine, in which the fibrous substance suspension is supplied from at least one distributor (11, 31, 51, 71, 101, 106, 121, 126, 137, 141, 142, 148, 150), via a guiding device (12, 32, 52, 72, 102, 122, 152), into a nozzle (14, 34, 54, 74, 104, 124, 154), from which it exits via a slit (19, 39, 59, 79), characterized

in that different additives are metered into the fibrous suspension on at least two different levels in the z direction.

2. Method according to Claim 1, characterized in that as additives, fillers, chemicals, in particular, retention agents, starch, fibrous substance suspension, or mixtures thereof are metered in.

3. Method according to one or more of the preceding claims, characterized in that seen in the z direction, a smaller amount of retention agent is metered to the middle of the sheet than to the boundary areas of the fibrous substance suspension.

4. Method according to one or more of the preceding claims, characterized in that seen in the z direction, a smaller amount of fillers and/or fine substances are metered to the middle of the sheet than to the boundary areas.

5. Method according to one or more of the preceding claims, characterized in that seen in the z direction, additives which increase the strength are metered to the middle of the sheet, and that additives which improve the imprinting capacity are metered to the boundary areas.

6. Method according to one or more of the preceding claims, characterized in that the pulp consistency of the fibrous substance suspension is regulated over the machine width (y direction) in zones, whereas the zone by zone volume flows of the fibrous substance suspension are kept essentially constant.

7. Method according to one or more of the preceding claims, characterized in that the volume flows of the metered-in additives are kept constant by admixing an aqueous accompanying medium.

8. Method according to one or more of the preceding claims, characterized in that the additives are metered in, in the guiding device (12, 32, 52, 72, 102, 122, 152), in the nozzle (14, 34, 54, 154), and/or in the distributor (11, 141, 148, 150).

9. Method according to one or more of the preceding claims, characterized in that the metering in is regulated, in zones, over the machine width (y direction) and/or in the z direction.

10. Method according to one or more of the preceding claims, characterized in that a change of the weight per unit area, caused by the metering-in of additives over the machine width (y direction) is compensated for via a regulation of the material flow from the distributor (101, 121, 137, 141) and a admixed fibrous substance suspension with another concentration.

11. Method for the distribution of a fibrous substance suspension in a multilayer material feed of a /10
paper machine, in which the fibrous substance suspension is conducted into nozzles (14, 34, 54, 74, 104, 124, 154) from at least two distributors (11, 31, 51, 71, 101, 106, 121, 126, 137, 141, 142, 148, 150), via guiding devices (12, 32, 52, 72, 102, 122, 152); from these nozzles, they exit via slits (19, 39, 59, 79), in particular, according to [one] or more of the preceding claims, characterized in that seen in the z direction, a fibrous substance suspension with a higher freeness value, with a higher filler or fine substance fraction, or with a smaller amount of chemically digested and stronger fibers is supplied in the boundary areas than in the middle of the sheet.

12. Method according to Claim 11, characterized in that seen in the y direction, a fibrous substance suspension with other characteristics is supplied in the boundary areas than in the middle of the sheet.

13. Method according to one or more of the preceding claims, characterized in that seen in the y direction, additives in other quantities or with other characteristics are metered in to the fibrous substance suspension into the middle of the sheet than those to the boundary areas.

14. Material feed for a paper machine with a distributor (11, 31, 51, 71, 101, 106, 121, 126, 137, 141, 142, 148, 150), to distribute a fibrous substance suspension over the machine width, which is connected with a nozzle (14, 34, 54, 74, 104, 124, 154), via a guiding device (12, 32, 52, 72, 102, 122, 152); from the nozzle the fibrous substance suspension exits via a slit (19, 39, 59, 79), and with a metering device

with metering conduits (20-28, 40-46, 60-64, 80-82, 111-113, 134-136), to meter in additives, characterized in that different metering conduits discharge in the z direction on at least two different levels.

15. Material feed according to Claim 14, characterized in that the metering conduits (20-28, 40-46, 60-64, 80-82, 111-113, 134-136) discharge into the guiding device (12, 32, 52, 72, 102, 122), into the nozzle (14, 34, 54, 74, 104, 124), and/or into the distributor (11, 31, 51, 71, 101, 106, 121, 126, 137).

16. Material feed according to Claim 15, characterized in that downstream (seen in the x direction), several metering conduits (40, 41, 42, 43) are located one behind the other.

17. Material feed according to one or more of Claims 14 to 16, characterized in that a regulating device (18) is provided for the regulation of the volume flow of the metered-in additives, which preferably makes possible a regulation of the supply of the additives, separated in the y direction and/or in the z direction.

18. Material feed according to one or more of Claims 14 to 17, characterized in that at least one lamella (37, 57, 58) is provided in the nozzle (34, 35), and that at least some of the metering conduits (63, 64) discharge via the lamella (57, 58).

19. Material feed for a paper machine with a distributor (212) to distribute a fibrous substance suspension via the machine width, which is connected with a nozzle (218), via a guiding device (214), from which the fibrous substance suspension exits via a slit (221), wherein the material feed, seen over the machine width (y direction), comprises several sections (S_1, S_2, S_3), to which, via metering conduits (222, 234, 248, 282, 284) with regulating elements (224, 236, 250, 252, 254), additives, in particular, dilution water, can be admixed locally, via several exit openings (231, 232, 233, 245, 246, 247, 263, 264, 265, 272), in particular, according to one of Claims 14 to 18, characterized in that an individual metering conduit (222, 234, 248, 282, 284) is correlated with several sections (S_1, S_2, S_3...), with the

metering conduit being subdivided into several conduit branches (228, 230, 240, 242, 244, 258, 260, 262, 266, 268, 286, 288), which are connected with the exit openings (231, 232, 233, 245, 246, 247, 263, 264, 265, 272).

20. Material feed according to Claim 19, characterized in that in at least one metering conduit (222, 234), the different conduit branches (228, 230, 240, 242, 244) are coupled with a common regulating element (224, 236).

21. Material feed according to Claims 19 or 20, characterized in that in at least one metering conduit (222, 282, 284), the different conduit branches (228, 230, 266, 268, 286, 288) from the opposite sides discharge into the section (S_1, S_2, S_3...).

22. Material feed according to Claim 21, characterized in that in at least one metering conduit (222, 282, 284), the different conduit branches (228, 230, 266, 268, 286, 288) discharge from above and from below into the section (S_1, S_2, S_3...). /11

23. Material feed according to one or more of Claims 14 to 22, characterized in that in at least one metering conduit, the different conduit branches seen in the y direction discharge next to one another into the section.

24. Material feed according to one or more of Claims 14 to 23, characterized in that in at least one metering conduit (234, 248), the different conduit branches (240, 242, 244) seen in the direction of the main flow (x direction) discharge one after the other into the section (S_1, S_2, S_3...).

25. Material feed according to one or more of Claims 14 to 24, characterized in that in at least one metering conduit (248), several conduit branches (258, 260, 262) are provided with a regulating element (250, 252, 254).

26. Material feed according to one or more of Claims 14 to 25, characterized in that the sections have different widths.

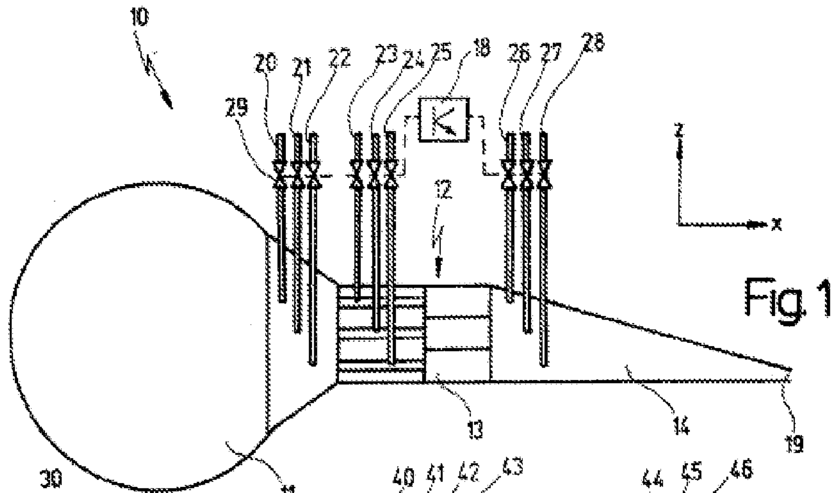


Fig.1

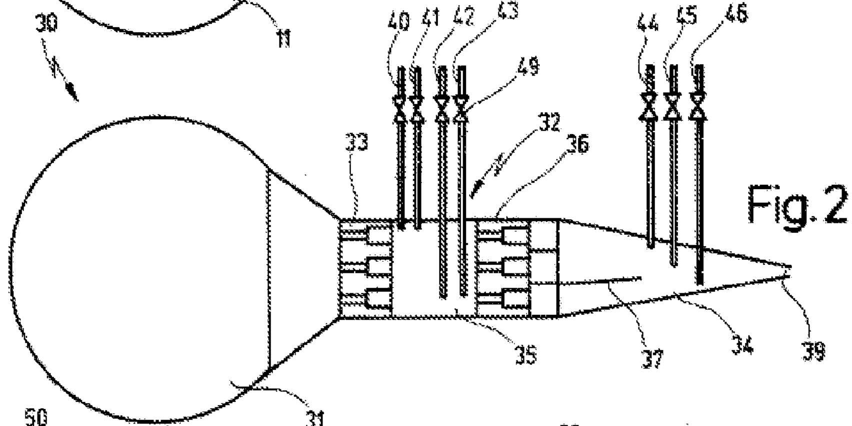


Fig.2

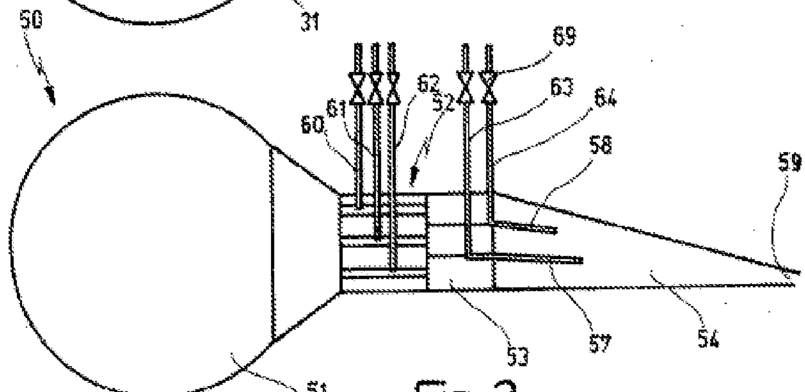


Fig. 3

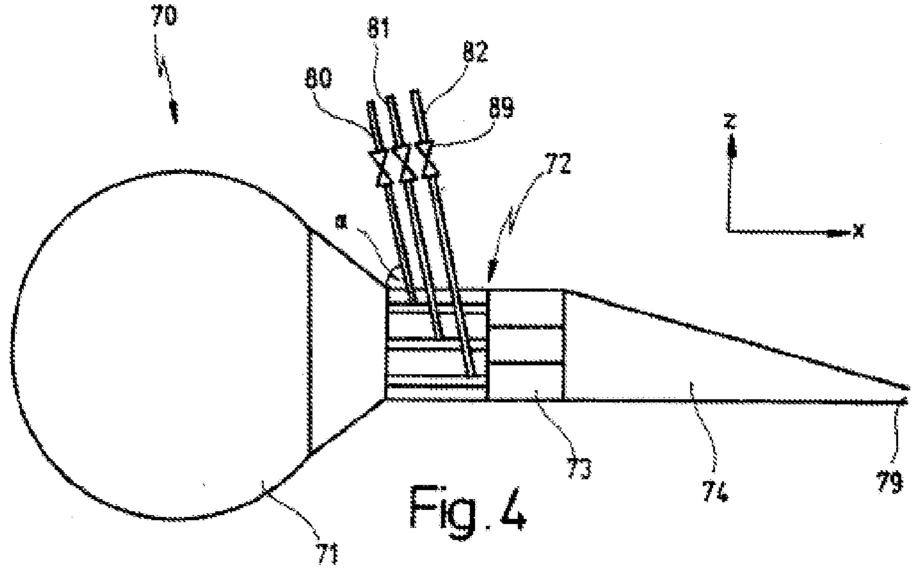


Fig. 4

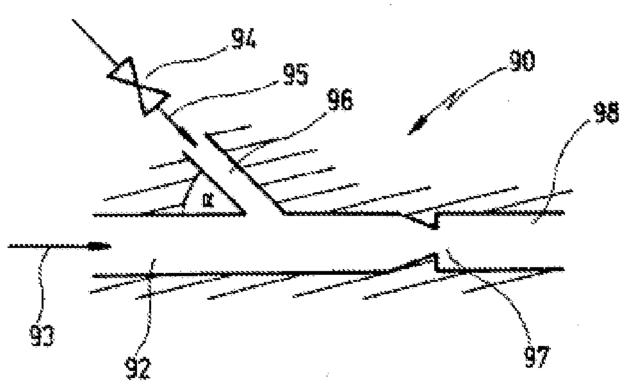
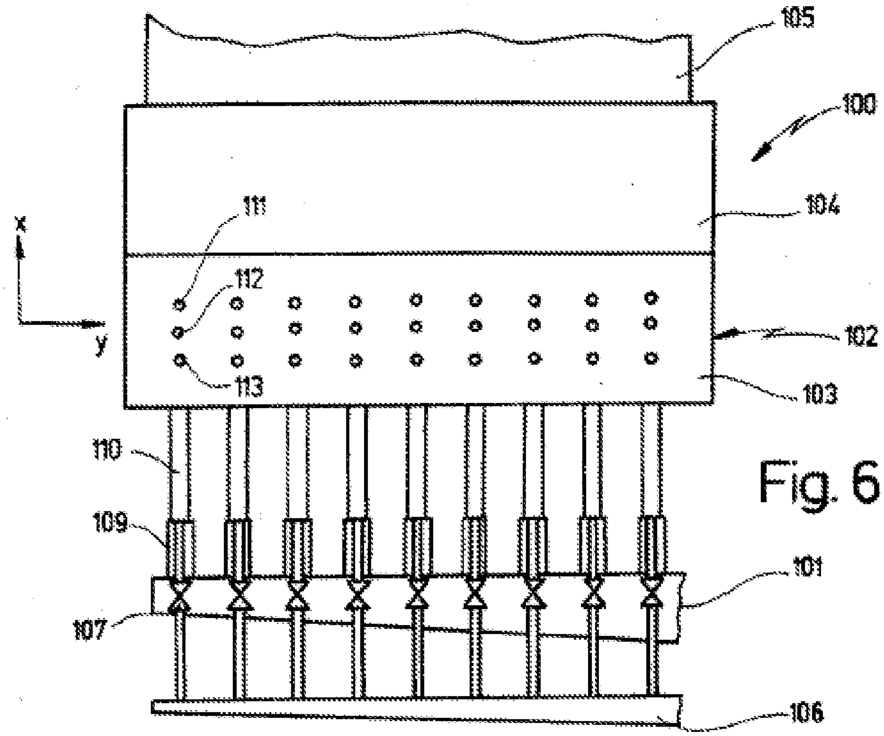


Fig. 5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106

Fig. 6

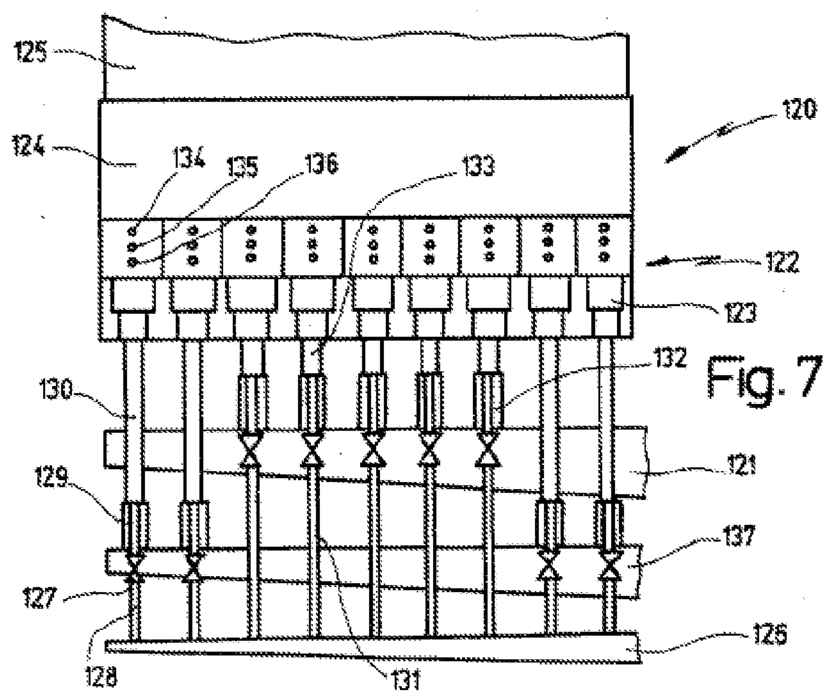
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Fig. 7

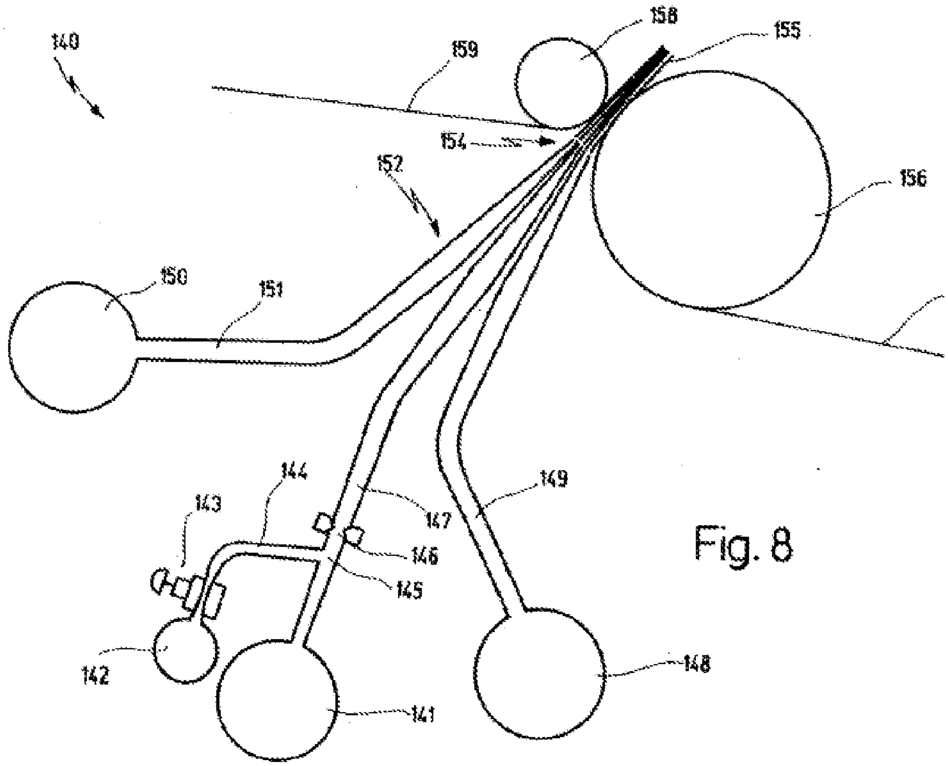
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Fig. 8

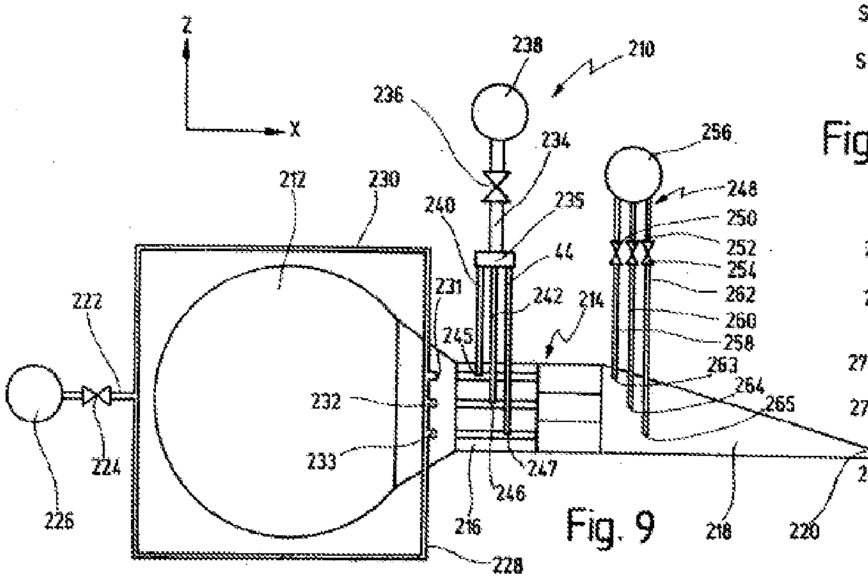
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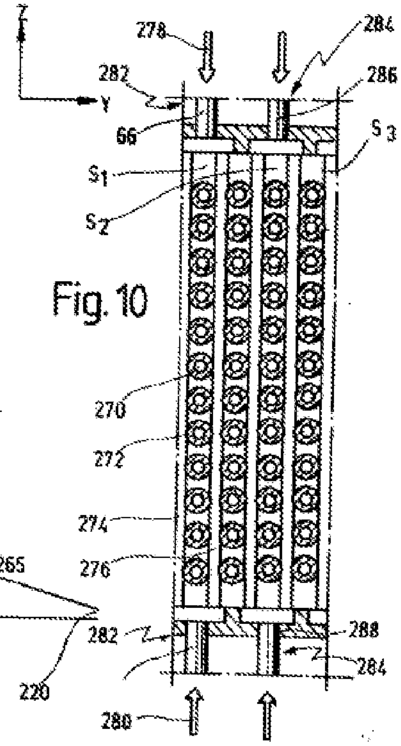
Fig. 9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S_1
S_2
S_3
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276

Fig. 10